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**COOPERATIVE SWEET SORGHUM
VARIETY TESTS FOR SIRUP
DURING 1971
IN FIVE SOUTHEASTERN STATES**

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Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE
in cooperation with
the Agricultural Experiment Stations of
Alabama, Florida, Georgia, and Mississippi

COOPERATIVE SWEET SORGHUM VARIETY TESTS FOR SIRUP DURING 1971 IN FIVE SOUTHEASTERN STATES

By Kelly C. Freeman, Dempsey M. Broadhead, and Natale Zummo¹

SUMMARY

Thirteen varieties of sweet sorghum, *Sorghum bicolor* (L.) Moench, were evaluated for sirup production at two or more locations. Test data on yield, growth characteristics, erectness, uniformity of stalk size and maturity, disease resistance, and quality indicate that 'Mer. 67-10' merits consideration for release for commercial production. 'GA 710 Sy' was the most productive variety at most locations where it was planted and evaluated.

Diseases of economic importance were rough spot in Alabama, Florida, Georgia, and Mississippi, bacterial stripe in Georgia, and rust and zonate leaf spot in Louisiana.

INTRODUCTION

Experimental plots for testing 13 sweet sorghum varieties, *Sorghum bicolor* (L.) Moench, for adaptation and sirup production were planted in 5 Southeastern States—Alabama, Florida, Georgia, Louisiana, and Mississippi. All tests included 'Brandes' (the standard), 'Mer. 67-9', 'Mer. 67-10', 'Mer. 67-11', 'Mer. 67-17', 'Mer. 67-18' and 'Dale'. Six additional varieties, 'GA 710 Sy', '1845E', '1984E', 'Mer. 70-1', 'Mer. 70-2', and 'Williams' were planted in Florida and Georgia. The tests at Quincy, Fla., and Cairo, Ga., failed because of insect injury and excessive drought.

METHODS

A randomized complete-block design with five

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replications of each variety was used. Each plot included three rows within an area of 0.02 acre, except at Houma, La., where a single row 12.5 feet long, with two replications, was used for determining reaction to natural rust infection. The seed in most tests were planted with hill-drop planters, with hills 2 feet apart in the drill, and the plants were thinned to three or four per hill. In the remaining tests, the seed were drilled with a spout drill, and the plants were thinned to 6- to 8-inch spacing. The plots were cultivated with conventional tractor cultivators. All varieties were harvested when the seed were in the dough stage of maturity except at Experiment, Ga., where the date of harvest had to be approximated as a result of seed removal by birds.

All stalks from the center row of each plot were weighed to determine gross yield. A 10- to 15-stalk sample was taken at random, then weighed, topped, and stripped of leaves, and finally reweighed to determine net millable stalk yield. This sample also provided a mill sample to obtain juice for Brix and sucrose analyses and a composite-variety juice sample for sirup processing. Each composite-variety juice sample was evaporated to sirup density (108° C) in an experimental steam evaporator. At least two 2-ounce clear-glass bottles were retained from each variety for g sirup quality.

RESULTS AND DISCUSSION

In the stalk yield tests the standard variety stalks per acre and tons per acre. The

and '1845E' (male sterile 'Williams' \times 'Wiley' and 'Brandes', respectively) were vigorous in growth and exceeded 'Brandes' by 43 and 24 percent. 'Mer. 67-10' was more uniform in growth and maturity than the other 'Mer. 67' selections, and it exceeded the stalk yield of 'Brandes' by an average of 15 percent.

Table 2 shows the extraction of juice. 'Brandes' stalks averaged 43.3 percent. All varieties exceeded 'Brandes' in percent of juice extracted from the stalks.

Table 3 shows degrees Brix of extracted juice. 'Brandes' juice averaged 18.8 Brix. 'Dale', a midseason variety, had consistently high Brix except in the test at Verona, Miss. An experimental hybrid '1845E' (male sterile 'Williams' \times 'Brandes'), showed an 8 percent higher Brix than 'Brandes' at Houma, La.

Gallons of sirup per net ton of stalks as percent of 'Brandes' sirup per net ton of stalks is presented in table 4. 'Brandes' averaged only 15.2 gallons of sirup per ton of stalks, reflecting the effect of drought. In the test at Experiment, Ga., the low percentages for 'Williams' and 'Mer. 67-17' were attributed to the failure of their juices to boil to sirup density. This condition was probably caused by a buildup of starch in overripe stalks, where seeds were destroyed by birds.

In the sirup yield tests (table 5), hybrids 'GA 710 Sy' and '1845E' (male sterile 'Williams' \times 'Wiley' and 'Brandes') exceeded the yield of 'Brandes' by 58 and 34 percent. 'Mer. 67-10' and 'Mer. 67-11' were uniform in maturity and produced very high-quality sirup. These two selections originated from the same cross [('Wiley' \times 'C.P. Special') \times ('MN 1054' \times 'Mer. 51-2')]. 'Mer. 67-10' will be further evaluated for release for commercial production.

The days from planting to harvest of the varieties are shown in table 6. Drought during the growing season extended the number of days required for maturity (dough stage of seed development). 'Brandes' averaged 133 days to maturity and ranged from 118 to 155 days. 'Mer. 67-9', 'Mer. 70-1', and 'Mer. 70-2' showed considerable variation in maturity within plots.

Table 7 contains data on diseases of economic importance. Disease effects were evaluated on reductions in plant yield and quality and on percentage of leaf destruction. Rough spot infection was severe in tests in Alabama and Florida; Experiment, Ga.; and Lorman and Verona, Miss. Bacterial stripe was heavy at Blairsville, Ga., and rust and zonate leaf spot were severe at Houma, La. 'Brandes' and 'Mer. 67-18' showed resistance to rust at Houma.

TABLE 1.—Yield of stripped stalks

| Location | 'Brandes' (tons/ acre) | Pct of 'Brandes' | | | | | | | | LSD at— | | | | |
|------------------------|------------------------------|------------------|-----------------|-----------------|-----------------|-----------------|--------|----------------|---------|----------------|----------------|-----------------|---------------|---------------|
| | | 'Mer. 67-9' | 'Mer. 67-10' | 'Mer. 67-11' | 'Mer. 67-17' | 'Mer. 67-18' | 'Dale' | 'GA 710 Sy' | '1845E' | 'Mer. 70-1' | 'Mer. 70-2' | 'Wil- liams' | 0.05 level | 0.01 level |
| Alabama: Crossville... | 19.3 | 121 | 126 | 134 | 108 | 123 | 100 | .... | .... | .... | .... | .... | 10.3 | 14.0 |
| Georgia: | | | | | | | | | | | | | | |
| Blairsville..... | 16.7 | 122 | 93 | 70 | 88 | 104 | 79 | 187 | 151 | 114 | 138 | 105 | 20.4 | 27.2 |
| Experiment..... | 16.7 | 114 | 84 | 102 | 80 | 86 | 67 | 107 | 105 | 68 | 100 | 62 | 24.6 | 33.1 |
| Mean..... | 16.7 | 118 | 88 | 86 | 84 | 95 | 73 | 147 | 128 | 91 | 119 | 84 | .... | .... |
| Mississippi: | | | | | | | | | | | | | | |
| Lorman..... | 11.4 | 135 | 160 | 145 | 126 | 111 | 96 | .... | .... | .... | .... | .... | 15.6 | 21.4 |
| Meridian..... | 21.8 | 123 | 110 | 119 | 102 | 114 | 87 | 139 | 120 | .... | .... | .... | 19.7 | 26.6 |
| Pontotoc..... | 22.1 | 121 | 119 | 124 | 88 | 117 | 74 | .... | .... | .... | .... | .... | 10.0 | 13.7 |
| Verona..... | 25.0 | 121 | 138 | 122 | 120 | 117 | 89 | .... | .... | .... | .... | .... | 10.6 | 14.6 |
| Mean..... | 20.1 | 125 | 132 | 128 | 109 | 115 | 86 | 139 | 120 | .... | .... | .... | .... | .... |
| Mean of means.... | 18.7 | 121 | 115 | 116 | 100 | 111 | 86 | 143 | 124 | .... | .... | .... | .... | .... |

LSD Least significant difference.

TABLE 2.—*Juice extraction*

| Location | 'Brandes' (pct) | Pct of 'Brandes' | | | | | | | | | | LSD at— | | |
|--------------------------|--------------------|------------------|-----------------|-----------------|-----------------|-----------------|--------|----------------|---------|----------------|----------------|----------------|---------------|---------------|
| | | 'Mer. 67-9' | 'Mer. 67-10' | 'Mer. 67-11' | 'Mer. 67-17' | 'Mer. 67-18' | 'Dale' | 'GA 710 Sy' | '1845E' | 'Mer. 70-1' | 'Mer. 70-2' | 'Wil- iams' | 0.05 level | 0.01 level |
| Alabama: Crossville..... | 44.9 | 109 | 101 | 100 | 97 | 110 | 103 | .... | .... | .... | .... | .... | 7.1 | NS |
| Georgia: | | | | | | | | | | | | | | |
| Blairsville..... | 51.4 | 105 | 100 | 97 | 103 | 106 | 104 | 106 | 107 | 106 | 105 | 107 | 5.3 | 7.1 |
| Experiment..... | 47.3 | 109 | 103 | 105 | 104 | 114 | 102 | 106 | 106 | 100 | 103 | 99 | 104 | 8.9 |
| Mean..... | 49.3 | 107 | 102 | 101 | 104 | 110 | 103 | 106 | 106 | 103 | 104 | 99 | 106 | .... |
| Louisiana: Houma..... | 33.8 | 120 | 138 | 125 | 126 | 146 | 127 | 142 | 131 | .... | 129 | 141 | 135 | .... |
| Mississippi: | | | | | | | | | | | | | | |
| Lorman..... | 41.2 | 109 | 113 | 108 | 108 | 126 | 118 | .... | .... | .... | .... | .... | 7.8 | 10.7 |
| Meridian..... | 47.8 | 104 | 106 | 101 | 101 | 114 | 107 | 110 | 107 | .... | .... | .... | 5.0 | 6.7 |
| Pontotoc..... | 45.9 | 102 | 104 | 102 | 105 | 116 | 99 | .... | .... | .... | .... | .... | 5.0 | 6.8 |
| Verona..... | 45.7 | 108 | 109 | 105 | 112 | 116 | 110 | .... | .... | .... | .... | .... | 7.0 | 9.7 |
| Mean..... | 45.2 | 106 | 108 | 104 | 106 | 118 | 108 | .... | .... | .... | .... | .... | .... | .... |
| Mean of means..... | 43.3 | 110 | 112 | 108 | 108 | 121 | 110 | 119 | 115 | 103 | 116 | 120 | 120 | .... |

LSD Least significant difference. NS Not significant.

LSD Least significant difference. NS Not significant.

TABLE 3.—*Brix analysis*

| Location | 'Brandes' | Pct of 'Brandes' | | | | | | | | | | LSD at-- | | |
|--------------------------|-----------|------------------|--------------|--------------|--------------|--------------|--------|-------------|---------|-------------|-------------|------------|------------|------------|
| | | 'Mer. 67-9' | 'Mer. 67-10' | 'Mer. 67-11' | 'Mer. 67-17' | 'Mer. 67-18' | 'Dale' | 'GA 710 Sy' | '1845E' | 'Mer. 70-1' | 'Mer. 70-2' | 'Williams' | 0.05 level | 0.01 level |
| Alabama: Crossville..... | 23.1 | 92 | 91 | 92 | 97 | 94 | 101 | .... | .... | .... | .... | .... | 4.2 | 5.6 |
| Georgia: | | | | | | | | | | | | | | |
| Blairsville..... | 16.5 | 85 | 94 | 90 | 101 | 110 | 104 | 104 | 103 | 92 | 102 | 96 | 9.3 | 12.4 |
| Experiment..... | 20.7 | 99 | 94 | 96 | 112 | 83 | 109 | 103 | 98 | 103 | 94 | 95 | 6.2 | 8.3 |
| Mean..... | 18.6 | 92 | 94 | 93 | 106 | 96 | 106 | 104 | 101 | 103 | 98 | 96 | .... | .... |
| Louisiana: Houma..... | 16.6 | 89 | 67 | 69 | 90 | 88 | 100 | 82 | 108 | .... | 72 | 86 | .... | .... |
| Mississippi: | | | | | | | | | | | | | | |
| Lorman..... | 15.7 | 104 | 116 | 115 | 132 | 101 | 145 | .... | .... | .... | .... | .... | 9.0 | 12.4 |
| Meridian..... | 17.3 | 99 | 106 | 101 | 104 | 88 | 112 | 112 | 102 | .... | .... | .... | 6.8 | 9.2 |
| Pontotoc..... | 18.3 | 96 | 98 | 96 | 107 | 90 | 113 | .... | .... | .... | .... | .... | 6.8 | 9.3 |
| Verona..... | 16.9 | 92 | 93 | 98 | 96 | 78 | 92 | .... | .... | .... | .... | .... | 6.3 | 8.6 |
| Mean..... | 17.0 | 98 | 103 | 102 | 110 | 89 | 116 | .... | .... | .... | .... | .... | .... | .... |
| Mean of means..... | 18.8 | 93 | 89 | 89 | 101 | 92 | 106 | 99 | 104 | 103 | 92 | 91 | .... | .... |

LSD Least significant difference.

TABLE 4.—*Sirup yield per net ton of stalks*

| Location | 'Brandes' | | Pct of 'Brandes' | | | | | | | | | | 'Mer. 70-2' | 'Wil- liams' |
|------------------------|------------|--|------------------|--------------|--------------|--------------|--------------|--------|-------------|---------|---------|-------------|-------------|--------------|
| | (gal/ ton) | | 'Mer. 67-9' | 'Mer. 67-10' | 'Mer. 67-11' | 'Mer. 67-17' | 'Mer. 67-18' | 'Dale' | 'GA 710 Sy' | '1845E' | '1984E' | 'Mer. 70-1' | | |
| Alabama: Crossville... | 17.2 | | 102 | 94 | 97 | 87 | 101 | 101 | .... | .... | .... | .... | .... | .... |
| Georgia: | | | | | | | | | | | | | | |
| Blairsville..... | 14.2 | | 94 | 92 | 82 | 104 | 104 | 111 | 109 | 106 | 107 | 103 | 101 | 107 |
| Experiment..... | 16.8 | | 112 | 96 | 103 | (1) | 92 | 101 | 104 | 106 | 101 | 87 | 95 | (1) |
| Mean..... | 15.5 | | 103 | 94 | 95 | 52 | 98 | 106 | 107 | 106 | 104 | 95 | 98 | 54 |
| Mississippi: | | | | | | | | | | | | | | |
| Lorman..... | 10.5 | | 110 | 135 | 133 | 148 | 131 | 164 | .... | .... | .... | .... | .... | .... |
| Meridian..... | 14.5 | | 106 | 112 | 101 | 107 | 97 | 112 | 115 | 110 | .... | .... | .... | .... |
| Pontotoc..... | 14.5 | | 101 | 106 | 103 | 123 | 114 | 111 | .... | .... | .... | .... | .... | .... |
| Verona..... | 12.6 | | 104 | 106 | 110 | 113 | 102 | 110 | .... | .... | .... | .... | .... | .... |
| Mean..... | 13.0 | | 105 | 115 | 112 | 123 | 111 | 124 | .... | .... | .... | .... | .... | .... |
| Mean of means.. | 15.2 | | 103 | 101 | 101 | 87 | 103 | 110 | 111 | 108 | 104 | 95 | 98 | 54 |

¹ Failed to boil to sirup of proper density (108° C).

TABLE 5.—*Sirup yield per acre*

| Location | 'Brandes' (gal/acre) | Pct of 'Brandes' | | | | | | | | | | | |
|--------------------------|-------------------------|------------------|-----------------|-----------------|-----------------|-----------------|--------|----------------|---------|---------|----------------|----------------|-----------------|
| | | 'Mer. 67-9' | 'Mer. 67-10' | 'Mer. 67-11' | 'Mer. 67-17' | 'Mer. 67-18' | 'Dale' | 'GA 710 Sy' | '1845E' | '1984E' | 'Mer. 70-1' | 'Mer. 70-2' | 'Wil- liams' |
| Alabama: Crossville..... | 331 | 124 | 118 | 130 | 94 | 124 | 101 | ... | ... | ... | ... | ... | ... |
| Georgia: | | | | | | | | | | | | | |
| Blairsville..... | 236 | 116 | 86 | 58 | 91 | 108 | 89 | 205 | 161 | 122 | 143 | 138 | 114 |
| Experiment..... | 281 | 127 | 80 | 105 | (1) | 79 | 68 | 111 | 112 | 68 | 86 | 75 | (1) |
| Mean..... | 258 | 122 | 83 | 82 | 46 | 94 | 78 | 158 | 136 | 95 | 114 | 106 | 57 |
| Mississippi: | | | | | | | | | | | | | |
| Lorman..... | 119 | 150 | 218 | 194 | 187 | 146 | 160 | ... | ... | ... | ... | ... | ... |
| Meridian..... | 317 | 131 | 123 | 121 | 109 | 109 | 97 | 159 | 131 | ... | ... | ... | ... |
| Pontotoc..... | 321 | 122 | 125 | 127 | 108 | 133 | 82 | ... | ... | ... | ... | ... | ... |
| Verona..... | 316 | 126 | 146 | 134 | 134 | 119 | 98 | ... | ... | ... | ... | ... | ... |
| Mean..... | 268 | 132 | 153 | 144 | 134 | 127 | 109 | ... | ... | ... | ... | ... | ... |
| Mean of means..... | 286 | 126 | 118 | 119 | 91 | 115 | 96 | 158 | 134 | 95 | 114 | 106 | 57 |

¹ Failed to boil to sirup of proper density (108° C).

TABLE 6.—*Days from planting to harvest*

| Location | 'Brandes' (standard) | Test variety | | | | | | | | | | | |
|--------------------------|-------------------------|----------------|-----------------|-----------------|-----------------|-----------------|--------|----------------|---------|---------|----------------|----------------|-----------------|
| | | 'Mer. 67-9' | 'Mer. 67-10' | 'Mer. 67-11' | 'Mer. 67-17' | 'Mer. 67-18' | 'Dale' | 'GA 710 Sy' | '1845E' | '1984E' | 'Mer. 70-1' | 'Mer. 70-2' | 'Wil- liams' |
| Alabama: Crossville..... | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | ... | ... | ... | ... |
| Georgia: | | | | | | | | | | | | | |
| Blairsville..... | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 |
| Experiment..... | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 |
| Mean..... | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 |
| Mississippi: | | | | | | | | | | | | | |
| Lorman..... | 155 | 132 | 132 | 132 | 132 | 155 | 132 | ... | ... | ... | ... | ... | ... |
| Meridian..... | 150 | 142 | 150 | 142 | 142 | 142 | 128 | 142 | 142 | ... | ... | ... | ... |
| Pontotoc..... | 136 | 136 | 136 | 136 | 136 | 136 | 136 | ... | ... | ... | ... | ... | ... |
| Verona..... | 135 | 135 | 135 | 135 | 135 | 135 | 135 | ... | ... | ... | ... | ... | ... |
| Mean..... | 144 | 136 | 138 | 136 | 142 | 142 | 133 | ... | ... | ... | ... | ... | ... |
| Mean of means..... | 133 | 130 | 131 | 130 | 132 | 132 | 129 | 132 | 132 | 137 | 137 | 137 | 137 |

TABLE 7.—*Diseases of economic importance in 14 sweet sorghum sirup varieties*¹

| Location | 'Brandes' (standard) | Test variety | | | | | | | | | | | |
|------------------------------|-------------------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------|----------------|---------|----------------|----------------|-----------------|------------|
| | | 'Mer. 67-9' | 'Mer. 67-10' | 'Mer. 67-11' | 'Mer. 67-17' | 'Mer. 67-18' | 'Dale' | 'GA 710 Sy' | '1845E' | 'Mer. 70-1' | 'Mer. 70-2' | 'Wil- liams' | 'Honey' |
| Alabama: Crossville..... | INS, RS | RS | ..... | RS | RS | RS | RS | ..... | ..... | ..... | ..... | ..... | INS |
| Florida: Quincy..... | RS | RS | RS | R, RS | RS | RS | R, RS | RS | ..... | ..... | ..... | ..... | ..... |
| Georgia: Blairsville..... | ..... | BS | ..... | ..... | BS | BS | ..... | BS, R | ..... | BS, R | BS | BS | ..... |
| Experiment..... | RS | RS | RS | ..... | RS | LB | RS | RS | RS | PS, RS | RS | RS | RS |
| Louisiana: Houma..... | GLS, ZLS | GLS | R | R, ZLS | R, ZLS | GLS | R, ZLS | R, ZLS | ZLS | ..... | R, ZLS | R, ZLS | ..... |
| Mississippi: Lorman..... | ..... | RS | RS | RS | ..... | RS | ..... | ..... | ..... | ..... | ..... | ..... | GLS, RS |
| Meridian..... | ..... | RS | ..... | ..... | BS | ..... | BS, RS | ..... | ..... | ..... | ..... | ..... | ..... |
| Pontotoc..... | RS | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | RS |
| Verona..... | GLS. RS | ..... | RS | RS | RS | RS | RS | ..... | ..... | ..... | ..... | ..... | GLS, RS |

¹ The presence of disease is indicated only when it was severe enough to have caused a reduction in yield or quality. BS Bacterial stripe. GLS Gray leaf spot. INS Insecticide injury. PS Physiological spotting. R Rust. RS Rough spot. ZLS Zonate leaf spot.

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